Anti-proliferative Efficacy of Quercetin Nanoparticles in an *In-Vivo* Model

Project report submitted to Sister Nivedita University in partial fulfilment of the requirement for the degree of

MASTER OF SCIENCE
IN
BIOTECHNOLOGY

Submitted By
ADIBA SHAKIL
Registration ID: 230020520108
Enrollment ID: 2322210002052

Advisor
Dr. Biswarup Basu
Senior Scientific Officer
Chittaranjan National Cancer Institute

School of Health Science and Translational Research
Sister Nivedita University
Kolkata
June 2025

DECLARATION BY THE STUDENT

I hereby declare that the work which is being presented in this dissertation entitled **"Anti-proliferative Efficacy of Quercetin Nanoparticles in an *In-Vivo* Model"** in partial fulfilment of the requirements for the award of the degree of Masters of Biotechnology in Sister Nivedita University is an authentic record of my own work carried out during the period from January 1, 2025 to May 31, 2025 under the supervision of Dr. Biswarup Basu, Department of Neuroendocrinology and Experimental Hematology, Chittaranjan National Cancer Institute.

I acknowledge that I have read and understood the UGC regulations, 2018 (*Promotion of Academic integrity and Prevention of Plagiarism in Higher Educational Institutions*).

I confirm that this dissertation has been checked for plagiarism using the plagiarism checking software "Ithenticate". At the end of the dissertation, a copy of the summary report demonstrating similarities in content and its potential source (if any), generated online using plagiarism checking software is enclosed. I herewith confirm that the dissertation has been less than 10% similarity according to the plagiarism checking software's report and meets the UGC Regulations as well as plagiarism rules of Sister Nivedita University.

I further declare that no portion of the dissertation or its data will be published without the Institute's or supervisor's permission. I have not previously applied for any other degree or award using the topics and findings described in my dissertations.

6/6/25

(Signature of the students with Date)

Name of the Student: Adiba Shakil

Registration no. 230020520108

Department: Biotechnology

Acknowledgement

First and foremost, I would like to express my sincere gratitude to **Sister Nivedita University** for providing me with a platform to pursue my academic and research aspirations. I am deeply thankful to my Head of the Department, **Dr. Somsubhra Thakur Chowdhury**, for his guidance, encouragement, and constant support throughout the course of my studies.

I am profoundly grateful to **Dr. Jayanta Chakrabarti**, Director of **Chittaranjan National Cancer Institute (CNCI)**, for giving me the opportunity to carry out my dissertation work at this prestigious institute.

My heartfelt thanks go to my research supervisor, **Dr. Biswarup Basu**, Senior Scientific Officer of the Neuroendocrinology and Experimental Hematology lab at CNCI, for his invaluable mentorship, insightful suggestions, and unwavering support throughout my project. His guidance has been instrumental in shaping my research skills and deepening my understanding of scientific inquiry.

I would also like to extend my sincere appreciation to my guide, **Ms. Vijna Danish**, for her constant encouragement, patient supervision, and constructive feedback, which have significantly contributed to the successful completion of my dissertation.

I am also thankful to **Dr. Arijit Bhowmick** for his constant support and guidance, and all the lab research scholars who made this journey both educational and memorable, namely, **Pratititi Bhattacharjee**, **Sandip Ghosh**, and **Souvik Das**, for their cooperation, technical assistance, and camaraderie.

Last but not least, I would like to express my deepest gratitude to my family and friends for their unconditional love, unwavering belief in me, and emotional support during every phase of this journey. Their presence has been my greatest strength. This dissertation would not have been possible without the support, encouragement, and contributions of all the aforementioned individuals, to whom I am truly thankful.

Date: 06/06/25

Adiba Shakil

Abstract

Cancer continues to be a major global health issue, requiring the development of less harmful and more efficient treatment methods. Natural compounds with anti-proliferative and pro-apoptotic qualities, such as the flavonoid quercetin, which comes from plants, have drawn interest. However, quercetin's low bioavailability, rapid metabolism, and poor water solubility restrict its clinical utility. Drug delivery methods based on nanotechnology, especially solid lipid nanoparticles (SLNs) and poly(lactic-co-glycolic acid) (PLGA) nanoparticles, provide promising solutions to these problems. This study uses an *in-vivo* Ehrlich Ascites Carcinoma (EAC) mice model to examine the anti-tumor activity of quercetin-loaded SLN and PLGA nanoparticles. Five groups of mice were created: control (C), blank nanoparticle (B), free quercetin (Q), SLN-quercetin (NQ1), and PLGA-quercetin (NQ2). Tumor growth, histopathology, and organ toxicity were evaluated. The results showed that SLN and PLGA nanoformulations produced considerably greater tumor suppression rates of 38% and 72%, respectively, whereas free quercetin reduced tumor proliferation by 19%. With no discernible damage to the liver or kidney tissues, histopathological investigation verified increased necrosis and reduced cellular density in groups treated with nanoparticles. These results demonstrate that quercetin encapsulated in nanoparticles is more effective and biosafe than quercetin in its free form. The result encourages more research into phytochemical delivery methods based on nanocarriers for cancer treatment.

Keywords: *Quercetin*, *Nanoparticles*, *PLGA*, *Solid Lipid Nanoparticles*, *Ehrlich Ascites Carcinoma*, *Anti-cancer therapy*, *Tumor inhibition*